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Cost and Time Overruns in Major Defense Acquisition Programs

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Abstract

Cost and time overruns in Major Defense Acquisition Programs (MDAPs) have become a high-profile problem attracting the interest of Congress, government and watchdog groups. According to the GAO, the 96 MDAPs from FY2008 collectively ran \$296 billion over budget and were an average of 22 months behind schedule. President Obama's memo on government contracting of 4 March 2009 also highlighted this issue.

This paper presents interim findings of research on the root causes of cost and schedule delays for MDAPs. This research is ongoing and will incorporate the 2010 SAR data. The final findings and policy recommendations will be presented at the May 2011 Naval Post Graduate School annual Acquisition Symposium.

Introduction

Cost and time overruns in Major Defense Acquisition Programs (MDAPs) have become a high-profile problem attracting the interest of Congress, government and



watchdog groups. According to the GAO, the 96 MDAPs from FY2008 collectively ran \$296 billion over budget and were an average of 22 months behind schedule. President Obama's memo on government contracting of 4 March 2009 also highlighted this issue.

This paper presents interim findings of research on the root causes of cost and schedule delays for MDAPs. This research is ongoing and will incorporate the 2010 SAR data. The final findings and policy recommendations will be presented at the May 2011 Naval Post Graduate School annual Acquisition Symposium.

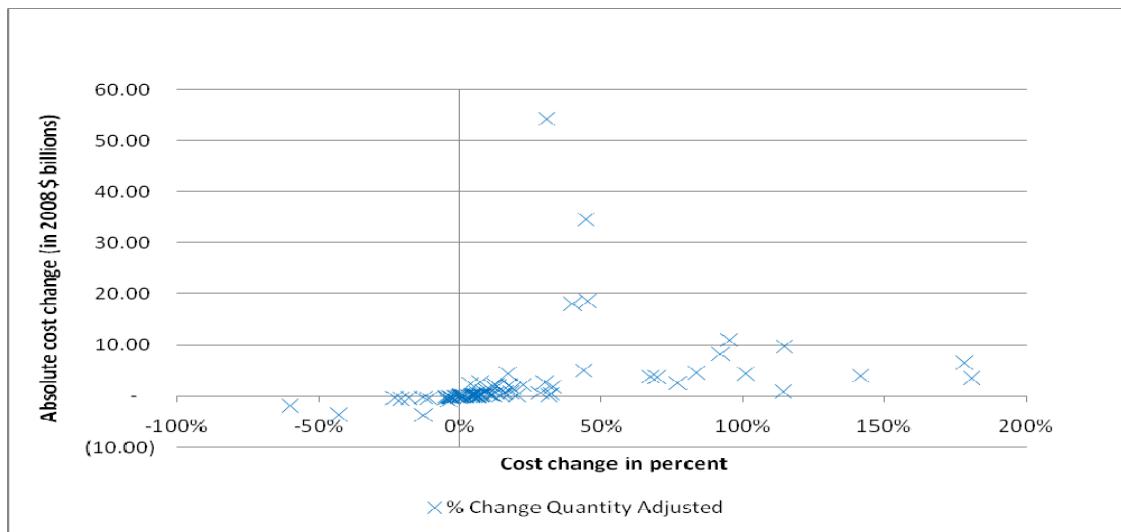


Figure 1. Relative Cost Growth Versus Absolute Cost Growth for FY2008 MDAPs

Note: Only FY2008 MDAPs with a baseline estimate beyond Milestone B in the September 2008 SAR were included

(Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

Problem Definition

Past studies on this topic either have not offered rigorous data analysis or were focused on a narrow aspect of the problem, such as technical maturity. As a result, acquisition reform efforts, most recently the Weapon Systems Acquisition Reform Act of 2009, are hampered by an insufficient analytical basis.

For instance, in its annual assessment of selected weapon systems, the GAO primarily focuses on technology maturity and associated program decisions as causes for these problems. Former Under Secretary of Defense for Acquisition Technology & Logistics John Young claimed in a memorandum on March 31, 2009, that many of the allegations of the GAO are based on inadequate analytical methods and that consequently many of the results are misleading.

This disagreement is exemplary of the diverging set of opinions that exists regarding the root causes of MDAPs cost overruns and schedule delays. The result amplifies disagreement regarding potential fixes. On the government side, Senator McCain identified the usage of cost plus contracts as a major source for cost increases and Secretary Gates pointed towards the contract structures as a key source of cost and schedule overruns in

some MDAPs. Defense contractors, on the other hand, regularly cite the altering of requirements in advanced program stages as an important factor for cost increases.

The currently ongoing process of reforming and fixing defense acquisition system still lacks the foundation of a detailed evaluation of the causality chain of cost overruns and program delays of MDAPs. This lack of understanding of underlying mechanism makes the design of adequate solutions inherently difficult and renders them potentially ineffective. This study directly aims at developing the urgently needed knowledge base that will better guide efforts to correct the growing trends of cost increases and schedule overruns.

Methodology

This brief analysis a series of variables—namely realism of baseline program cost estimates, government management and oversight, the role of contractors and lead military services, levels of competition, and contract structures—to determine what factors might contribute to the observed cost overruns in the execution of MDAPs.

The research draws on four primary data sources:

Selected Acquisition Reports (SARs): The SARs track Major Defense Acquisition Programs reporting on their schedule, unit counts, total spending, and progress through milestones. The unit of analysis is the programs themselves, making it the ideal source for top level analysis.

Federal Procurement Data System (FPDS): The FPDS is a database of every government contract, with millions of entries each year. Each entry has extensive data on the contractors, contract type, competition, place of performance, and a variety of other topics as mandated by Congress. Cross-referencing individual contracts with MDAPs is possible using the system equipment codes (which match up with those of MDAPs). This source provides the most in-depth data on the government contracting process.

Department of Defense Budget Documents: In addition to budget data, these documents provide topical information on each MDAP and its subcomponents. They will primarily be used to categorize projects as well as to support and double check spending figures from the other two sources.

The initial analysis phase focuses on MDAPs from the FY2008 MDAP list. Within this sample group, the analysis is limited to 87 MDAPs with cost estimates set at Milestone B or beyond. That gate is meant to be a hurdle that requires programs to reach a certain level of technological maturity. As a result Milestone B “is normally the initiation of an acquisition program.” This common starting point ensures that only programs in a relatively mature acquisition phase are compared. Unfortunately, full data is not available on all 87 MDAPs when examining contract type and competition because only a majority of the programs have at least 50% of the SARs contract value accounted for in 2004-2008 FPDS data. The “unclear” category is used to signify this missing data in competition and contract type findings. In addition, FPDS totals for program spending are sometimes higher than the funding status according to the SARs. In those cases, the SAR totals are treated as the more reliable figure.

This preliminary snapshot provides an adequate starting point for detecting correlations between a series of potentially relevant factors and cost growth. Subsequent analysis will examine multiple factors at the same time, expand the breadth of the sample group and will also test for correlations with regard to schedule overruns.



Analysis

The initial analysis focuses on examining the impact of baseline cost estimates, quantity and schedule changes, as well as engineering problems; the extent of competition in contracts (full and open, partial, none)¹; contract structure; lead branch of military service; and identity of prime contractor on the cost performance on MDAPs.

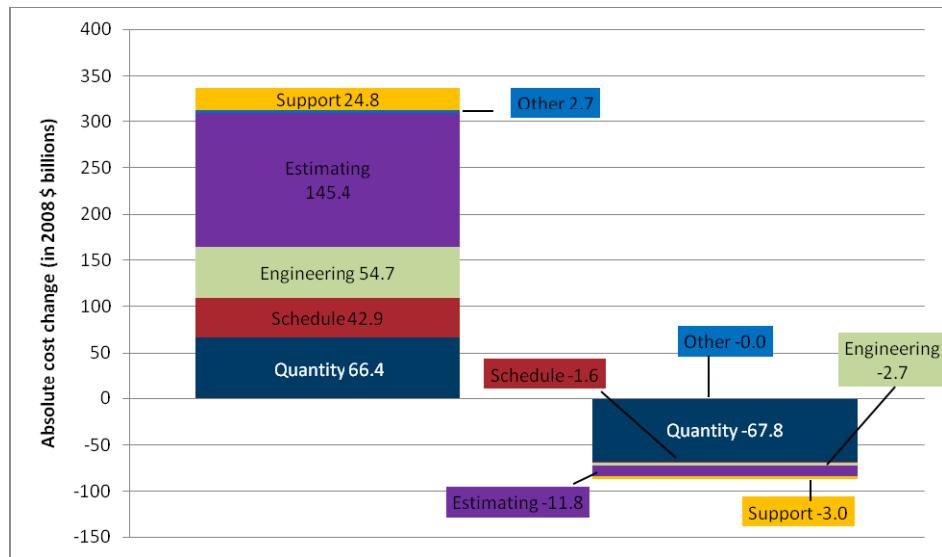


Figure 2. Functional Reasons for Cost Growth
(Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

Breaking down cost growth by functional areas as provided in the SARs identifies mistakes in the estimating process as the primary driver for cost growth, being responsible for \$145.5 billion in cost growth for the 87 MDAPs analyzed.

Another noteworthy observation is the fact that the cost savings achieved through quantity changes almost equals the cost growth originating from changes in unit numbers. Quantity based changes are unlike the five other types of changes as the SARs adjust the top-line cost overrun figures to remove the impact of quantity changes. The key distinction is that for programs with upfront research and development costs, reducing the number of units lowers the overall cost but increases the unit cost. In turn, cost increases deriving from increases in the number of units require a higher overall budget but lower the price per unit. Similarly, Nunn-McCurdy breaches are based on the growth in the acquisition unit cost and not the overall cost.

¹ Full competition refers to programs competed under full and open competition with at least two bidders. Partial competition includes all other competed contracts such as follow-ons to competed contracts, competitions where the number of bidders is legally limited, and full and open competition with only a single bidder.

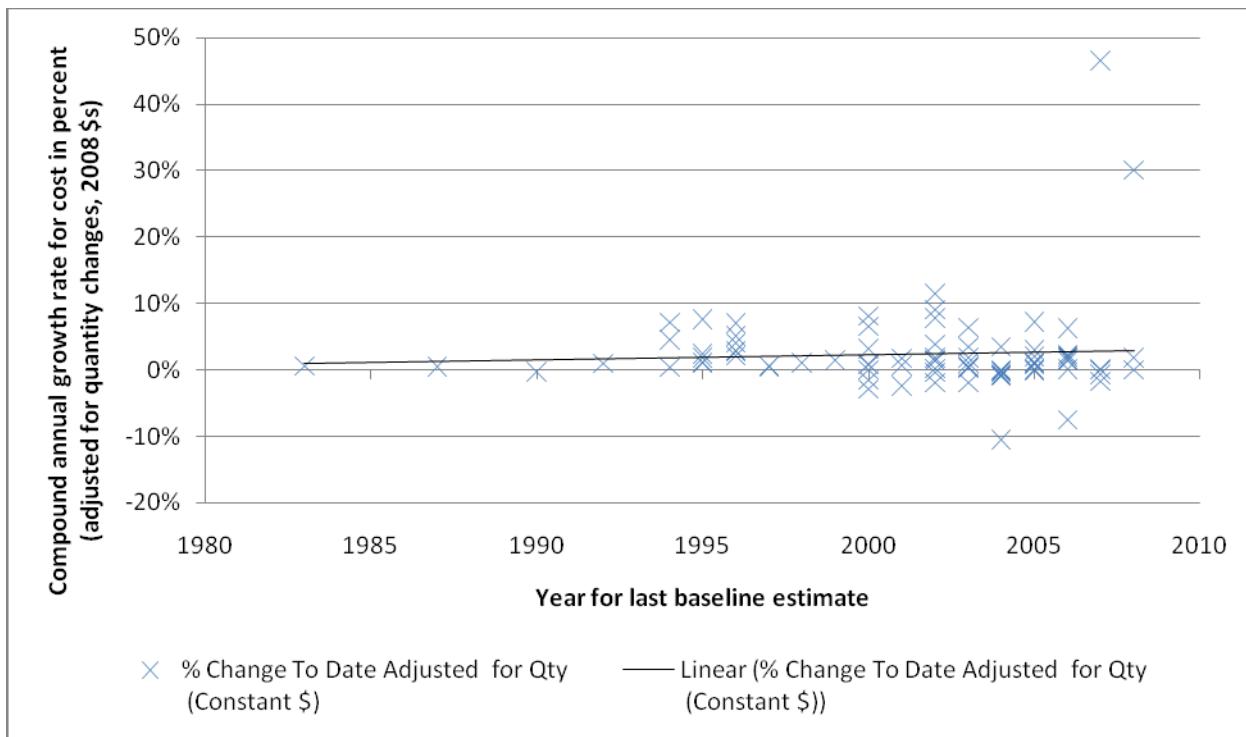


Figure 3. Time-cost Correlation
 (Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

The next explanatory variable examined for its impact on program performance is the time-cost growth correlation. If cost increases accrue over time then programs with an older baseline estimate would tend to accumulate relatively higher cost increases. The data for the analyzed programs shows that older programs indeed experience larger overruns.

When measured in compound annual growth rate² rather than aggregate relative cost growth, the time-cost growth correlation is almost constant. This does not only provide further evidence for the assertion that cost growth occurs steadily throughout the program lifespan, but it also suggests that younger programs are not performing better than older programs. On the other hand, this sample does not include older programs that were cancelled. Future research with a broadened sample set will be better able to avoid this confounding factor and thus provide more insight into the successes and failures of past reform efforts.

² The compound annual growth rate describes the average year-to-year cost growth of a program spending since its baseline. Thus if comparing two programs with same percentage of cost growth since their baseline estimate, the program with an earlier baseline year would have a smaller compound annual growth rate.

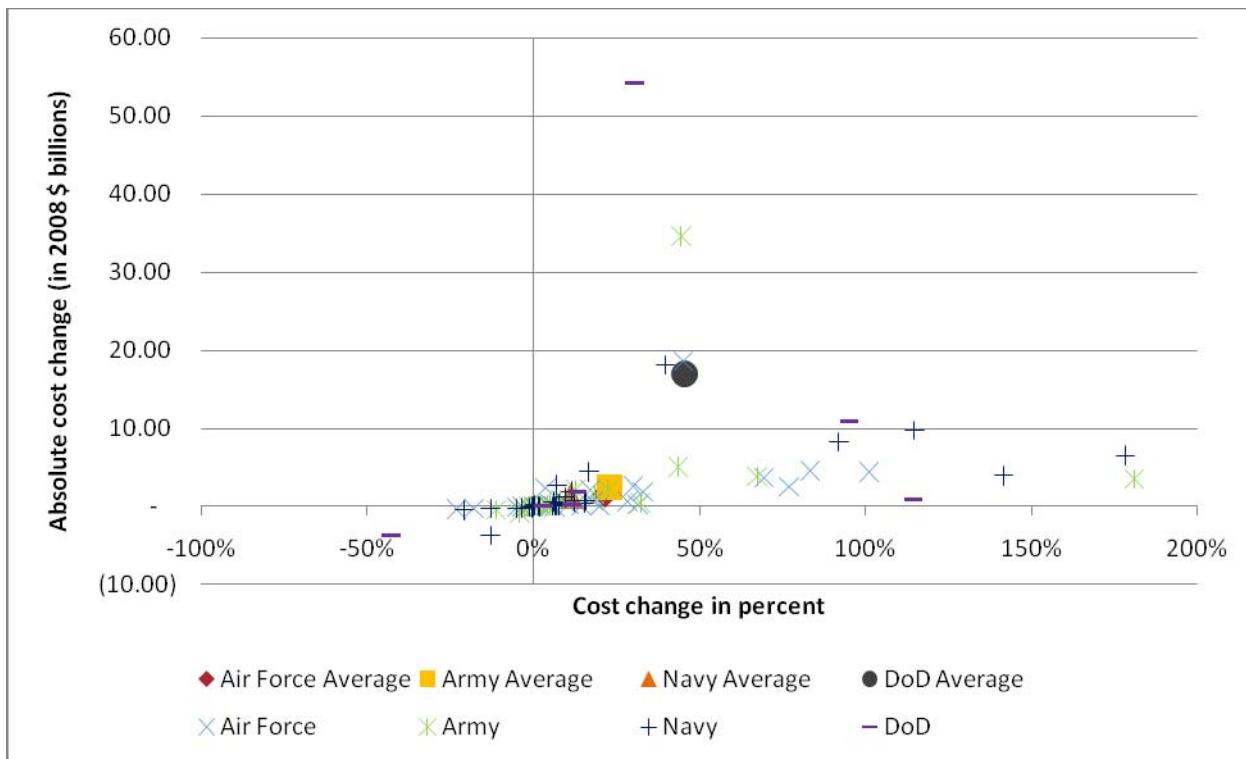


Figure 4. Cost Overruns by Lead Service (I)
 (Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

The analysis on the correlation between the lead branch of military service responsible for MDAPs and cost growth patterns reveals that programs led by the Navy appear to perform best, followed by the Air Force and Army, while DoD-wide programs tend to accrue significant higher cost overruns. As broken down by the SARs, DoD-wide refers not just to programs managed by DoD agencies but also joint programs such as the Joint Strike Fighter. The outcome of this data analysis might be skewed based on the relatively small sample group utilized in this preliminary analysis. For instance, it appears that the DoD-wide category might be heavily influenced by the negative developments for the Joint Strike Fighter program. As for the other components, further analysis with larger sample groups are required to validate observed trends.

Any conclusions identifying superior program management of existing programs by the better performing services as means of avoiding cost growth would be premature, even if additional data and analysis will confirm this variation in cost performance based on lead service. A number of other factors occurring before Milestone B may explain the differences, such as a tendency toward less risk-prone MDAPs or better cost estimating at the outset of programs. Further research will be needed to analyze the underlying causality and detect the true root causes for these trends.

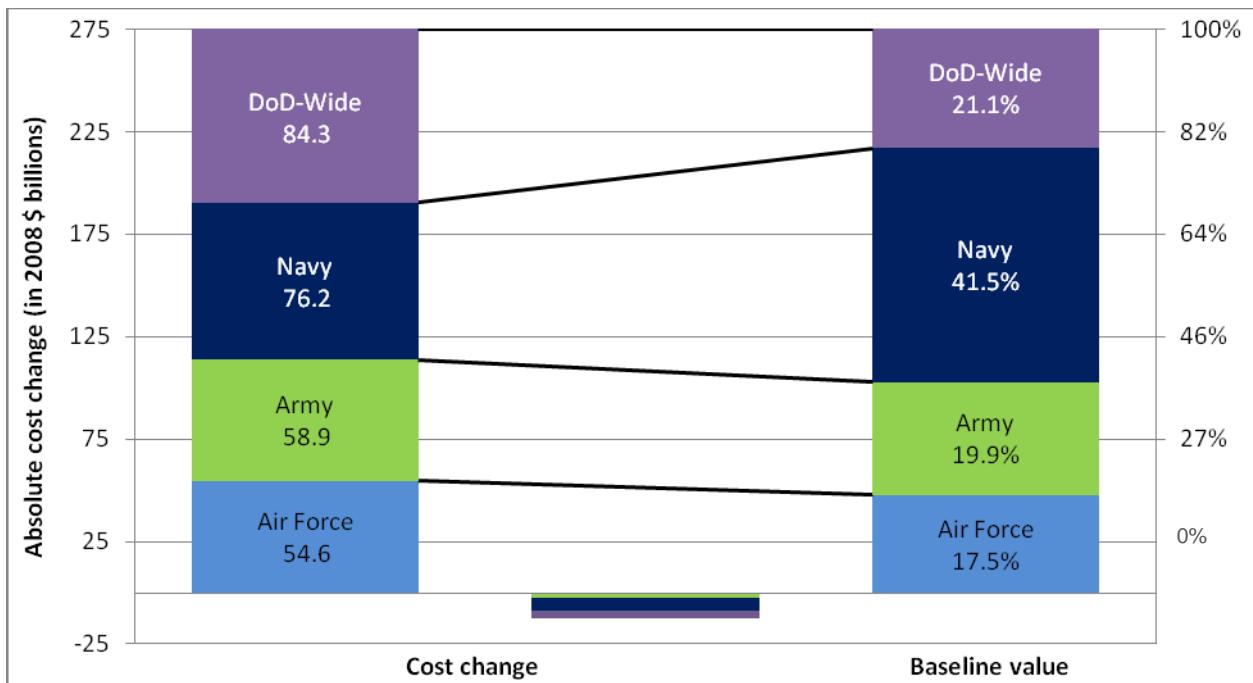


Figure 5. Cost Overruns by Lead Service (II)
 (Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

Comparing the share of cost growth for which each service is responsible with the share of contract value, based on baseline estimates, which each service is managing supports the poor cost performance of DoD-wide managed MDAPs. DoD-wide led programs are responsible for an over-proportional large share of absolute cost overruns. The picture is reversed for the Navy, meanwhile for the Air Force and the Army the share of cost overruns and is slightly larger than the share of baseline value. This comparison provides further support for the assertion that Navy managed MDAPs over-perform, while DoD-wide managed MDAPs underperform. However, the level of analysis conducted so far does not allow for any firm conclusions on the actual role of the Navy program management skills in these trends.

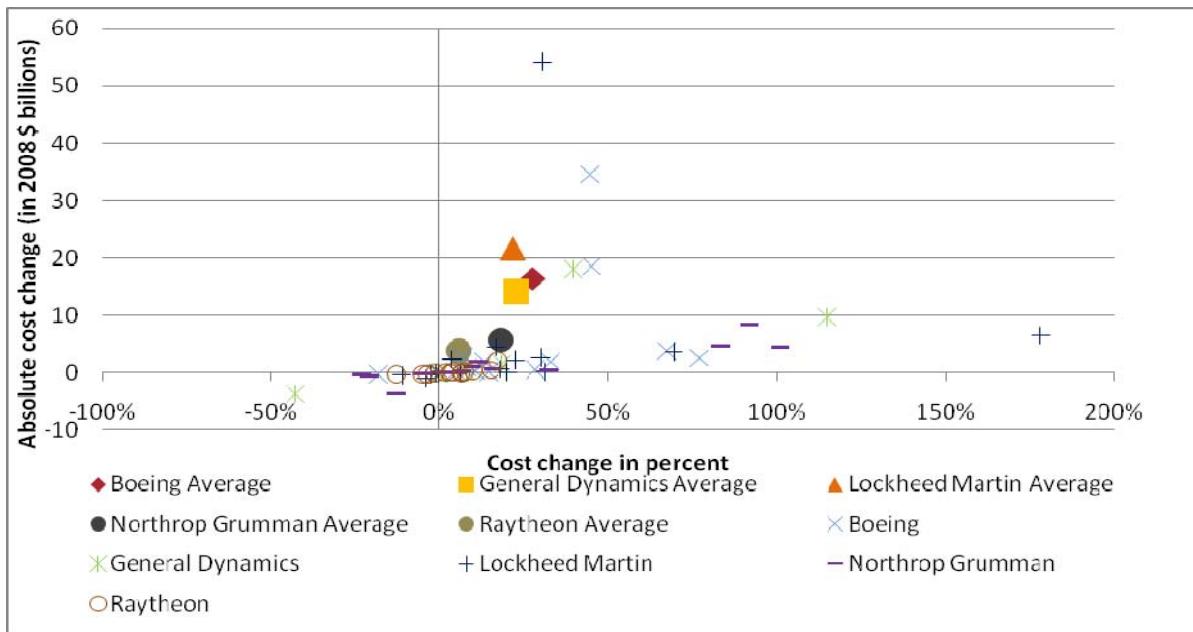


Figure 6. Cost Overruns by Prime Contractor (I)
 (Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

Another predictor for program performance could be the identity of the prime contractor executing a given program. The picture becomes a lot more complex, based on the amount of actors involved. One striking trend that is visible for the “big five” US defense companies is the fact that Raytheon on average appears to deliver significantly better cost performance outcomes than the other four defense companies.

Again, the preliminary character of the analysis does not fully validate these findings. In addition, even if confirmed, it would be premature to start praising Raytheon for superior program execution, as other factors such as specialization in technologically more mature program areas might be the true drivers behind this trend. As was the case for the breakdown by lead service, further research will be needed to analyze the underlying causality.

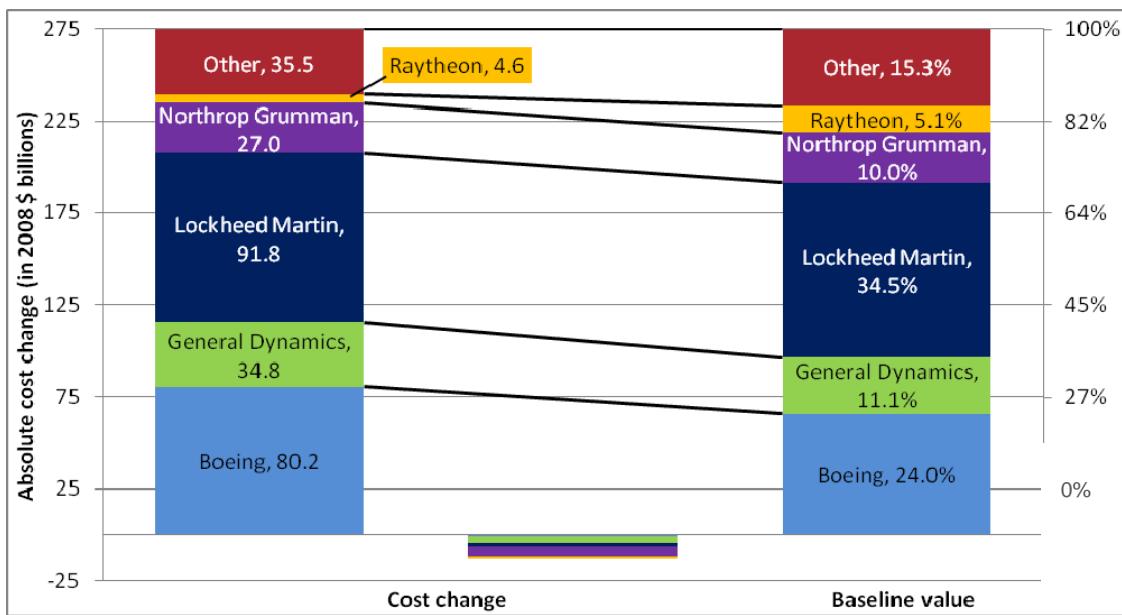


Figure 7. Cost Overruns by Prime Contractor (II)

(Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

The comparison between the share of cost growth and the share of contract value for MDAPs, aggregated by prime contractor correlates with the finding that Raytheon managed MDAPs appear to exhibit the best cost performance amongst the “big five” defense companies. However, the above graph also shows that the respectable performance of Raytheon contracted MDAPs has only a marginal impact on aggregate cost growth bottom line due to the small contract value share of Raytheon led programs.

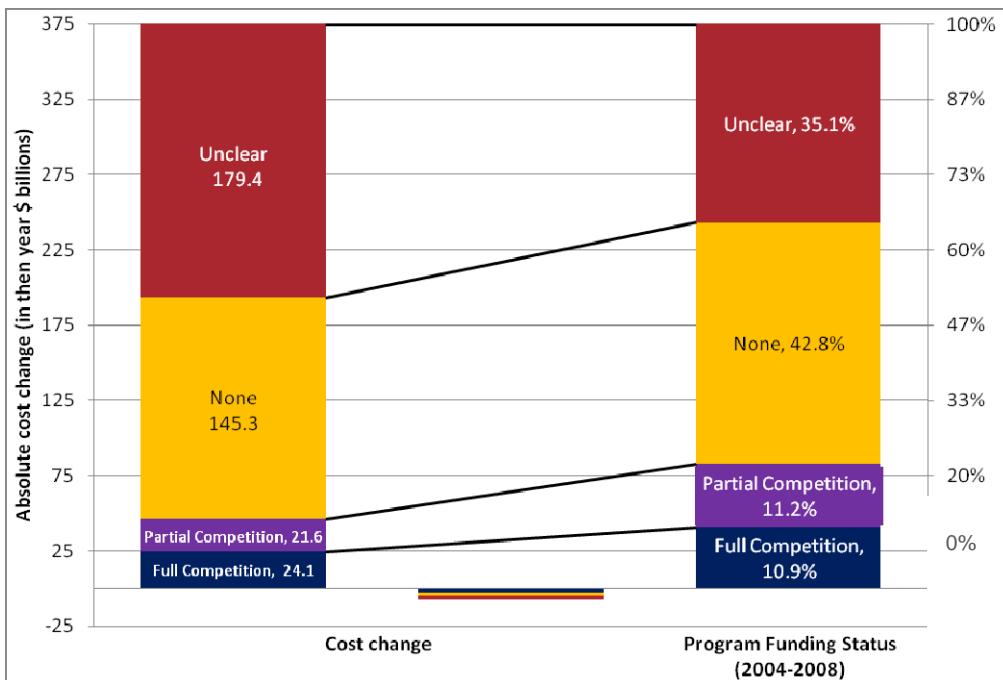


Figure 8. Cost Overruns by Type of Competition

(Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

Contract awarding mechanisms could potentially also have an impact on cost performance of MDAPs. Competitive contracts³ are outperforming contracts awarded with no competition or under unclear circumstances with regard to cost performance. This might indicate that competition either results in more realistic bids or that winning companies have more incentives to keep costs under control. This advantage holds for the category of partial competition, which includes cases open for competition but with only a single bidder, follow-ons to competed contracts, and competitions with a legally limited pool of applicants. In fact, somewhat surprisingly, partially competed MDAPs appear to have lower overruns than fully competed ones. However, without further study, it is impossible to say whether this is due to benefits of partially competitive structures or is fully competitive procedures are deemed to be a necessary for high risk programs.

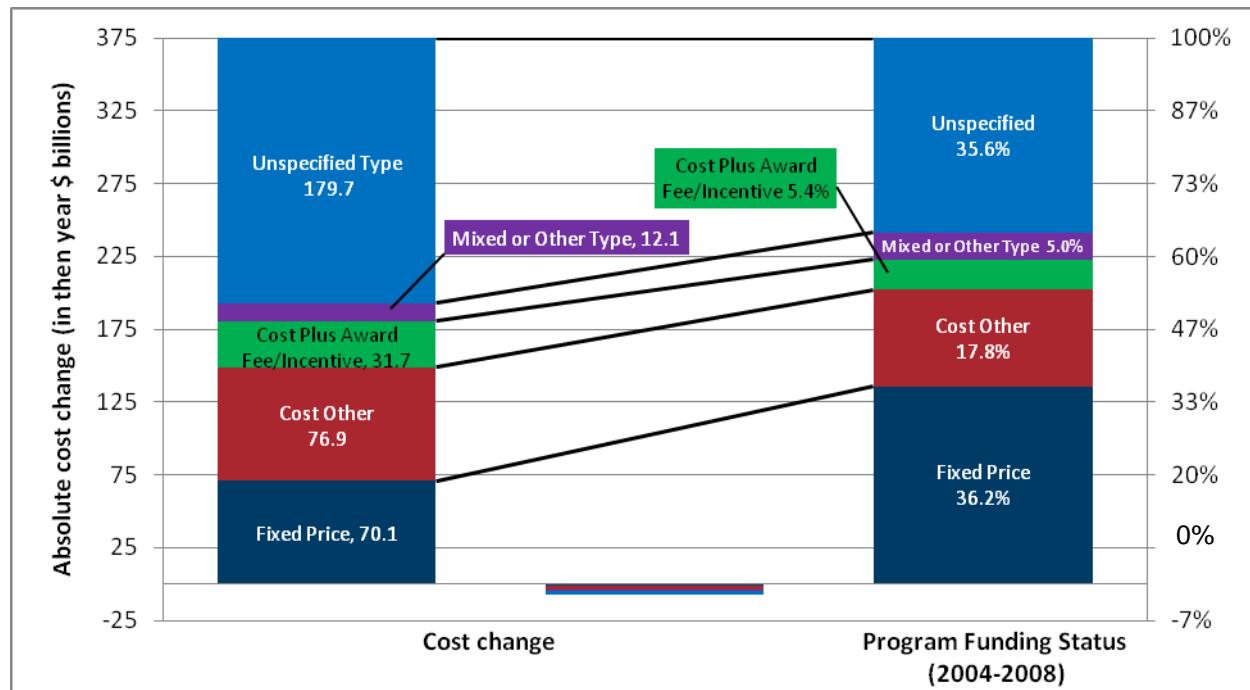


Figure 9. Cost Overruns by Contract Type

(Source: September 2008 SAR; analysis by CSIS Defense-Industrial Initiatives Group)

Contract structure provides another possible determining factor for the performance of MDAPs. One key observation is that fixed price contracts appear to over-perform and unspecified contract types appear to under-perform when comparing the share of cost growth and the share of contract value for MDAPs.

Acquisition reformers often point towards over- and misuse of cost plus contracts as a factor driving cost overruns. Yet as the comparison reveals the use of cost plus contracts, award fee and incentive as well as conventional, seem not to be responsible for dramatically over-proportional cost growth. In addition, fixed price contracts are often the vehicle of choice for mature technology in full rate production, which are generally considered low risk.

³ Full competition refers to programs competed under full and open competition with at least two bidders. Partial competition includes all other competed contracts such as follow-ons to competed contracts, competitions where the number of bidders is legally limited, and full and open competition with only a single bidder.

Preliminary Findings

The initial analysis yielded a number of preliminary trends for determining the sources of cost overruns in MDAPs. One key finding from the SAR data is that overly optimistic cost estimating is responsible for almost half of the accumulated cost overruns. In fact, of all the services the Army is the only one with cost estimating not being the primary reason for cost growth.

Of the tested variables, only the time-cost correlation appears to have no impact on cost overrun developments once accounted for on a compound annual growth rate. This suggests that program performance might not have been improving in recent times. If this trend is further validated it hints toward the concerning conclusion than any acquisition reform efforts prior to 2008 have so far failed to create any improvements for cost performance. In this context, it must, however, be noted that cost performance as measured in the SARs constitutes clearly a lagging indicator for the impact of any acquisition reform. In addition, some of the worst performing older programs of the past have already been cancelled and if included would increase the overrun compound annual growth rate for earlier years.

The examination of all of the other examined variables reveals patterns that suggest that each of them, or associated secondary or tertiary factors, could play a role in explaining the occurrence of MDAP cost overruns. While one service may appear to have the best cost performance; or one company may seem to deliver fewer cost-overrun programs of the “big five” defense contractors; fixed price contracts appear to constitute the contract vehicle with the best cost growth control; and awarding contracts in a competitive fashion seems to ensure better cost performance than alternative awarding mechanism, all of these trends need to be further validated through additional analysis, incorporating larger sample groups. Afterwards, more rigorous quantitative and qualitative analysis is required to identify the actual root causes for cost overruns, which might be only masked by the examined variables. Ongoing research will lead to better answers about these root causes.



Conference on Autonomic and Trusted Computing (ATC 2006) (pp. 500–510).

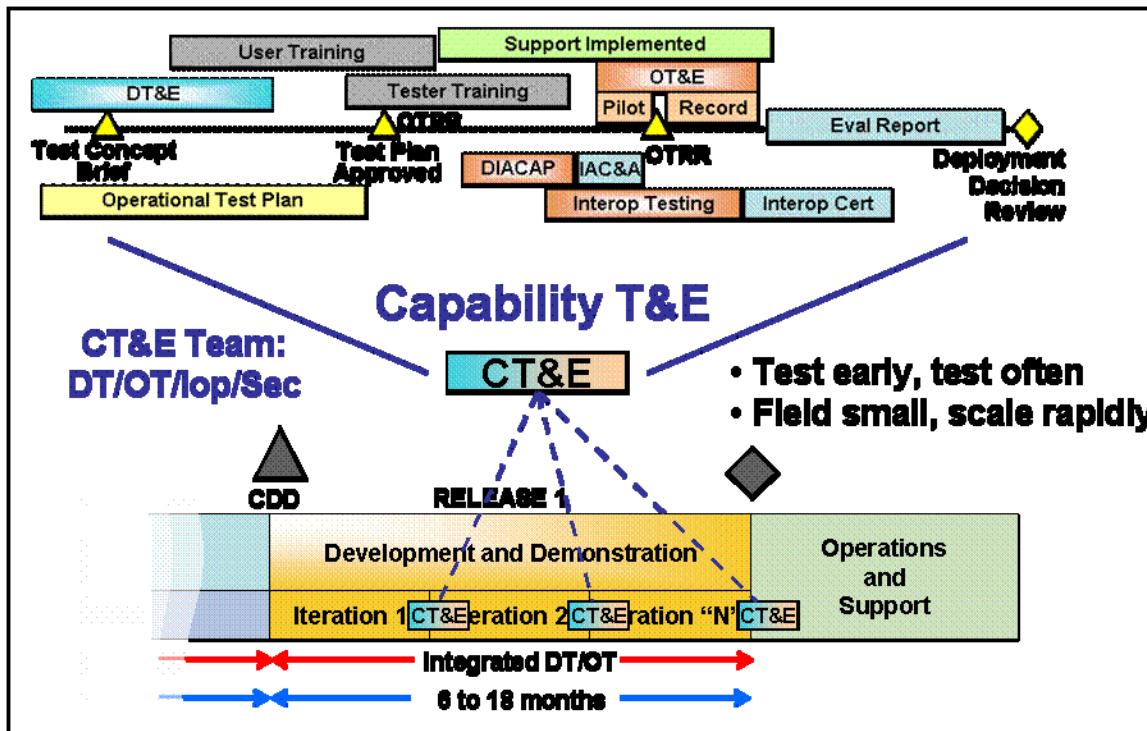


Figure 10. Agile T&E

Summary

Information technologies evolve rapidly, as is abundantly evident in the commercial sector. As the DoD acquires IT to enhance warfighting capabilities, we need to become more agile. Agility cannot just occur in capability development either; all aspects of the IT acquisition system must be redesigned for agility. To be responsive to operational requirements, and to ensure the capabilities work as intended, test, evaluation, and certification must move at the speed of need. The Defense Science Board reports provide a good starting point from which to build a new model for acquisition of IT; now, let's take the next bold step to implement agile processes that deliver enhanced IT capabilities for the warfighter.

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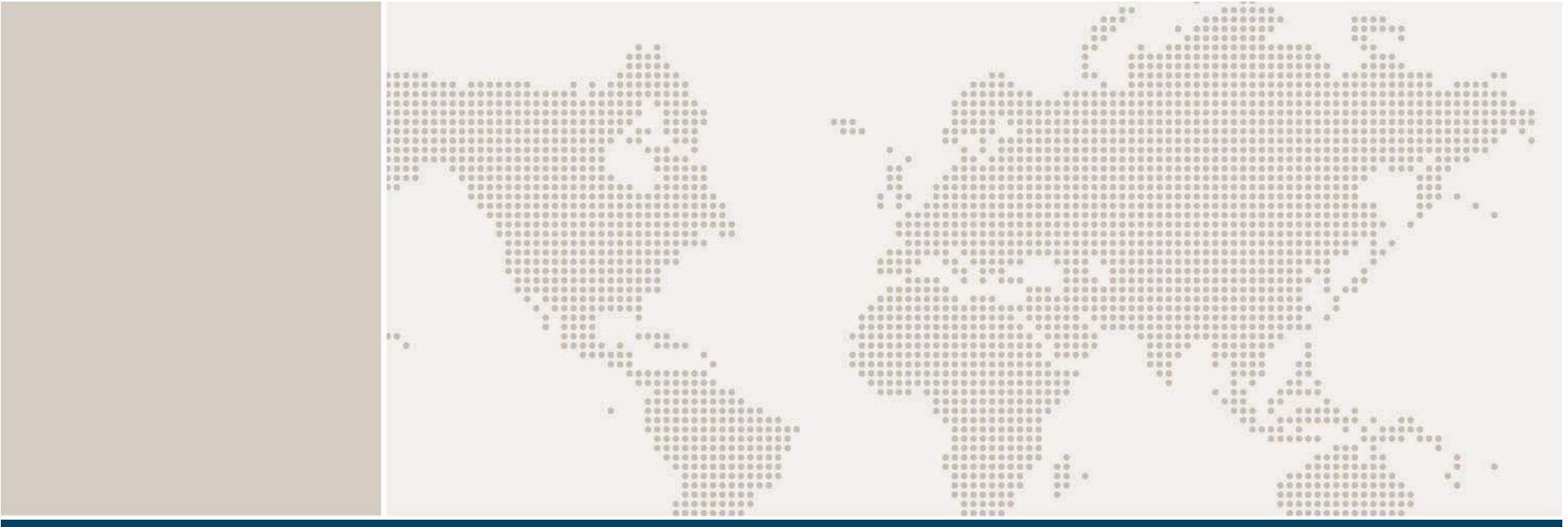
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Cost and time overruns in Major Defense Acquisition Programs (MDAPs)

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Center for Strategic and International Studies

May 13, 2010

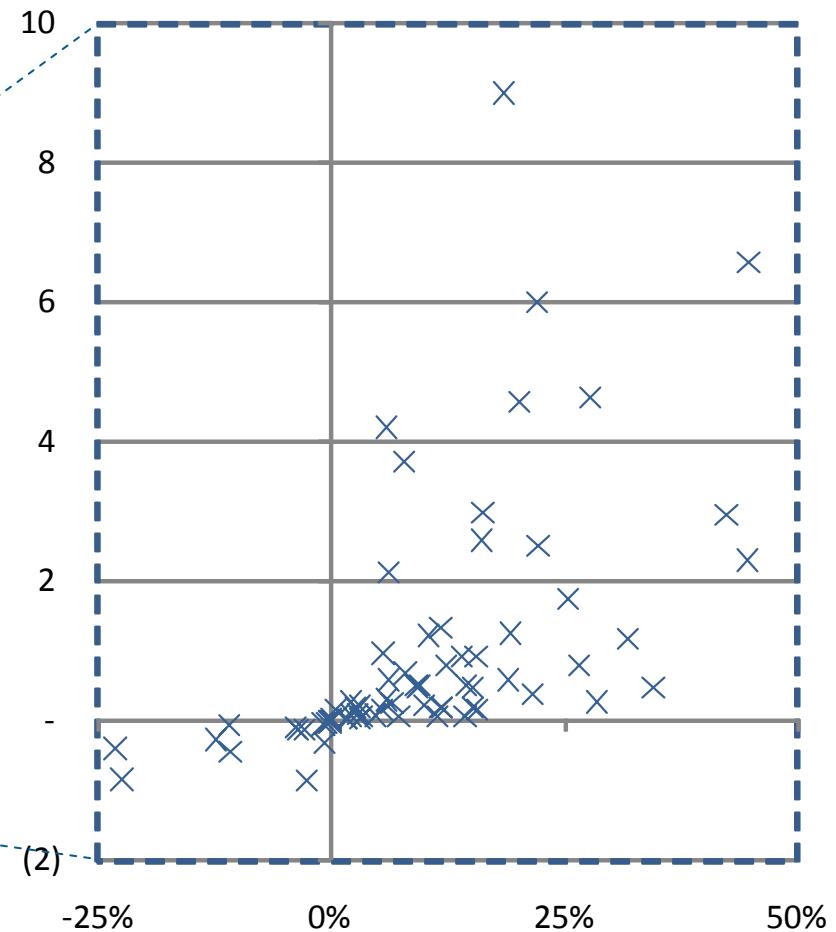
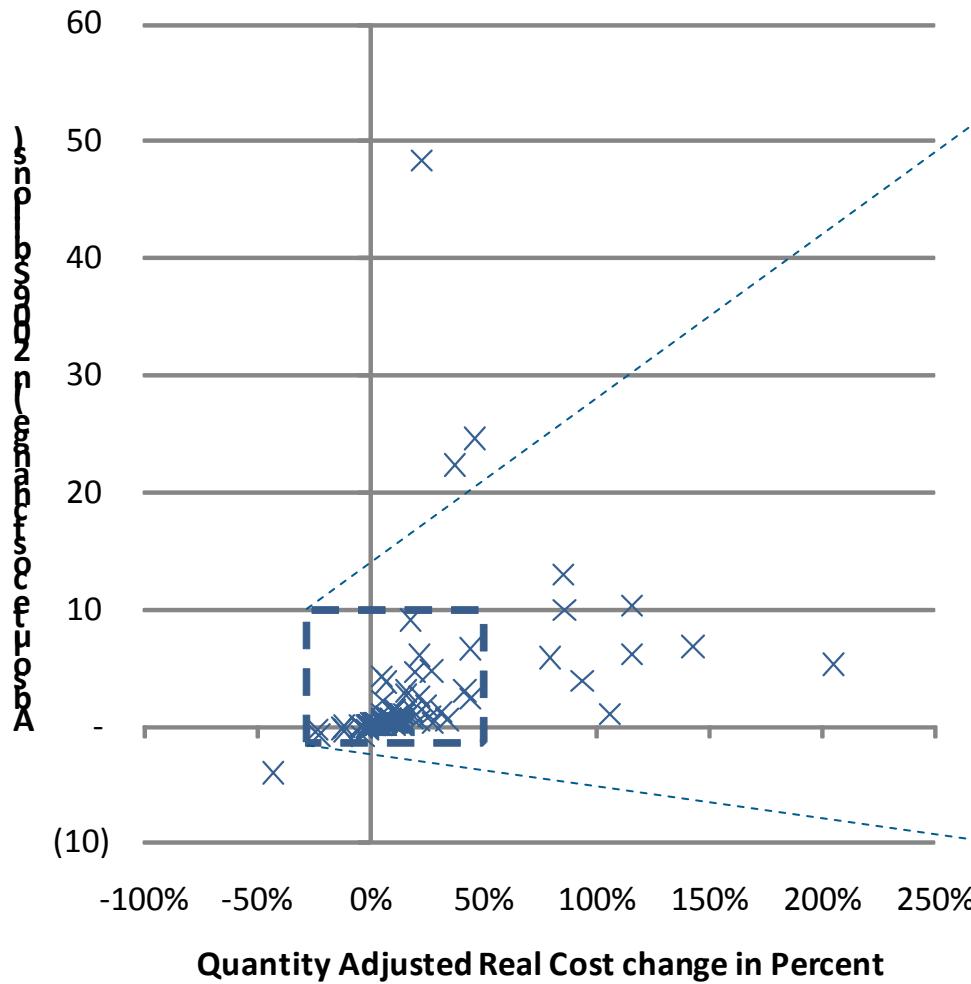
NPS 7th Annual Acquisition Research Symposium May 12-13, 2010

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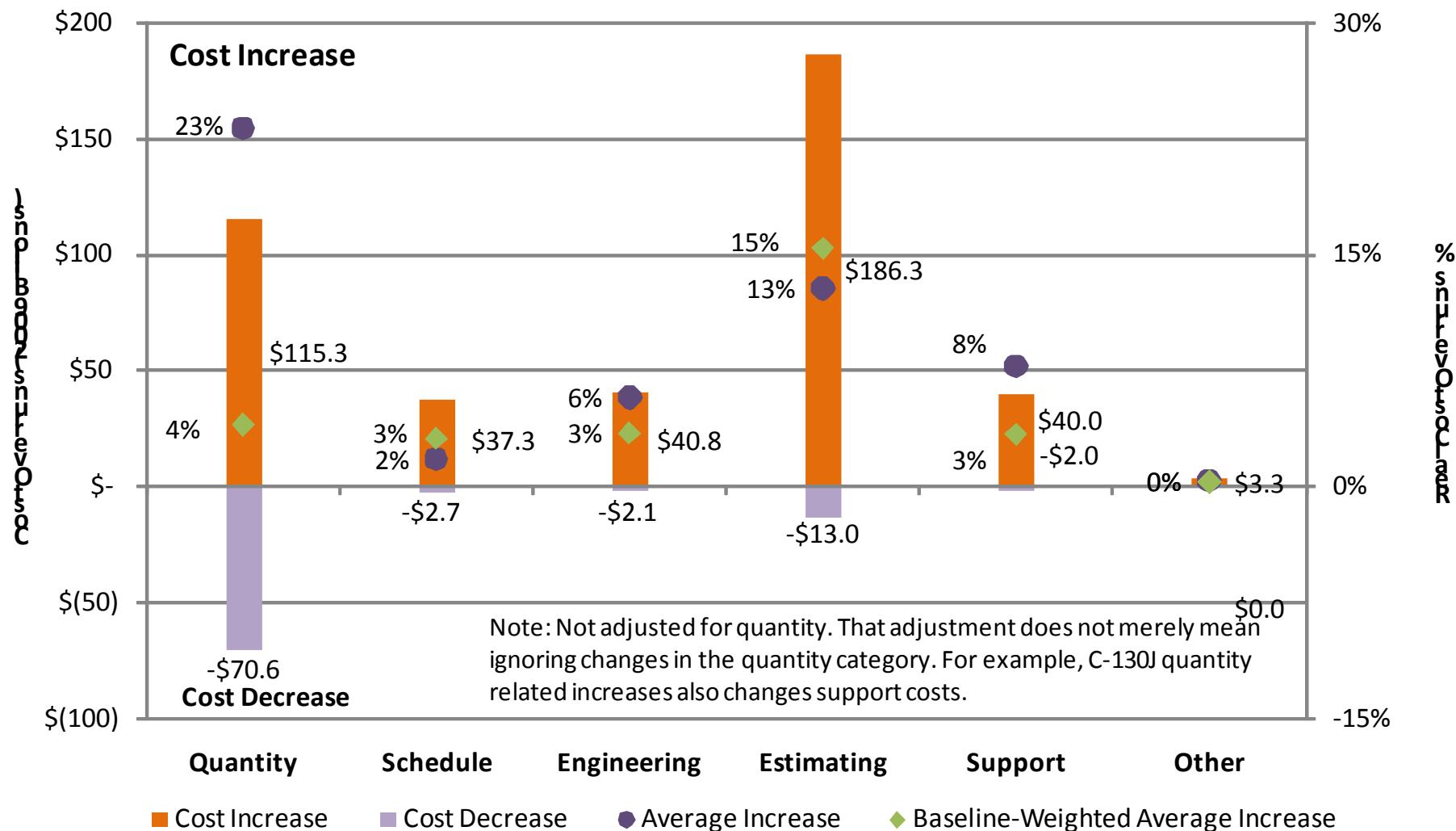
Defense-Industrial
Initiatives Group

Relative cost growth versus absolute cost growth



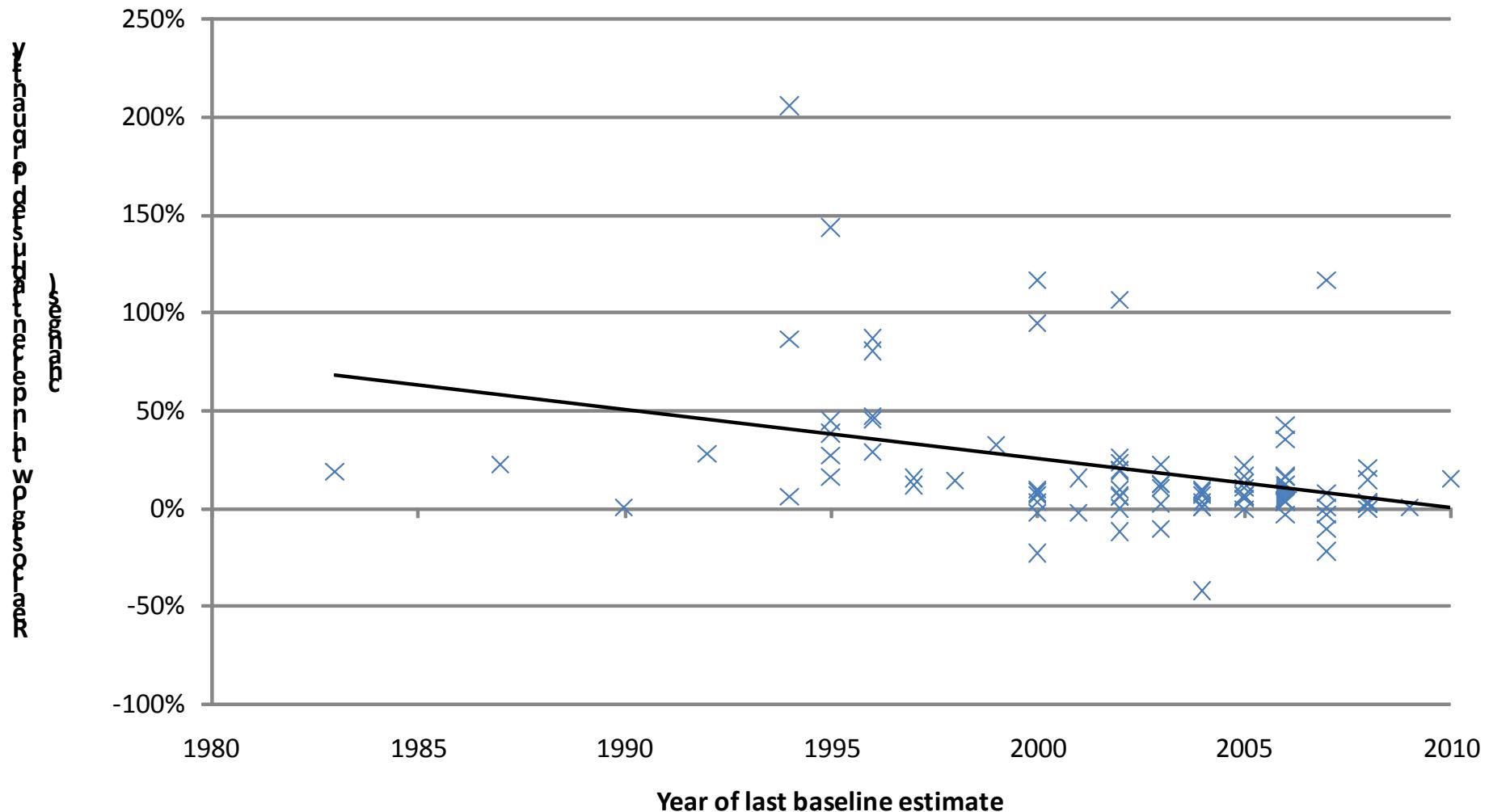
Note: Only FY2009 MDAPs with a baseline estimate beyond Milestone B in the December 2009 SAR are included in the sample.
Source: December 2009 SAR; analysis by CSIS Defense-Industrial Initiatives Group

Functional reasons for cost growth



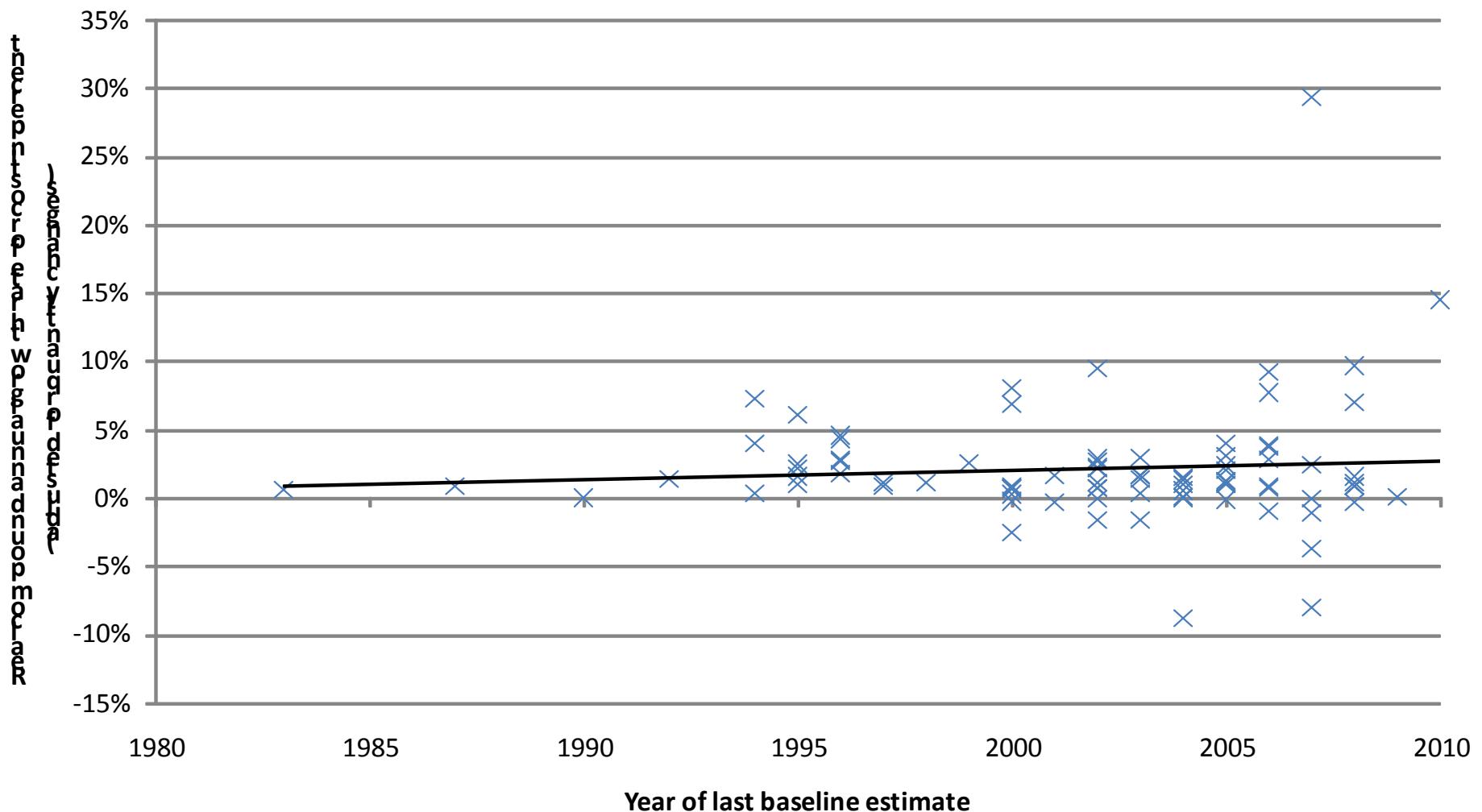
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Time-cost correlation (% Change)



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Time-cost correlation (Compound Annual Growth Rate)

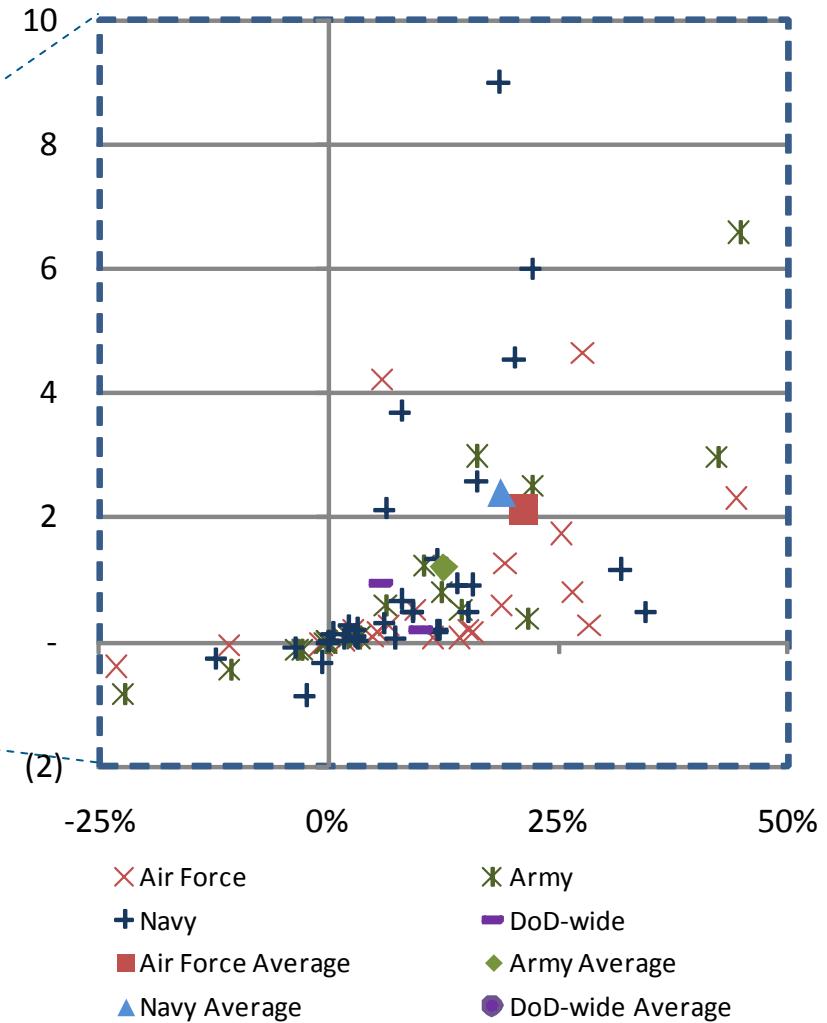
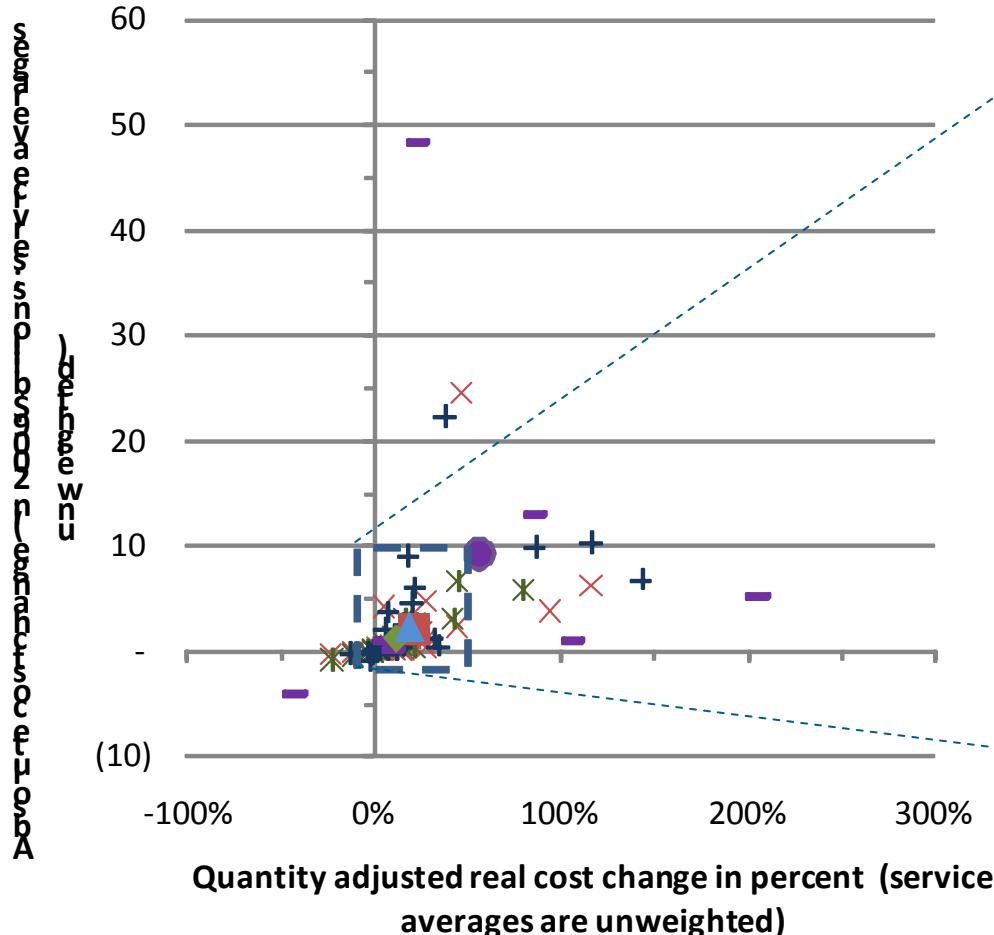


Note: Only FY2009 MDAPs with a baseline estimate beyond Milestone B in the December 2009 SAR are included in the sample.

WIN-T Increment 2 was changed baseline years in 2010, but the compound annual growth rate was calculated as if the change happened in 2009.

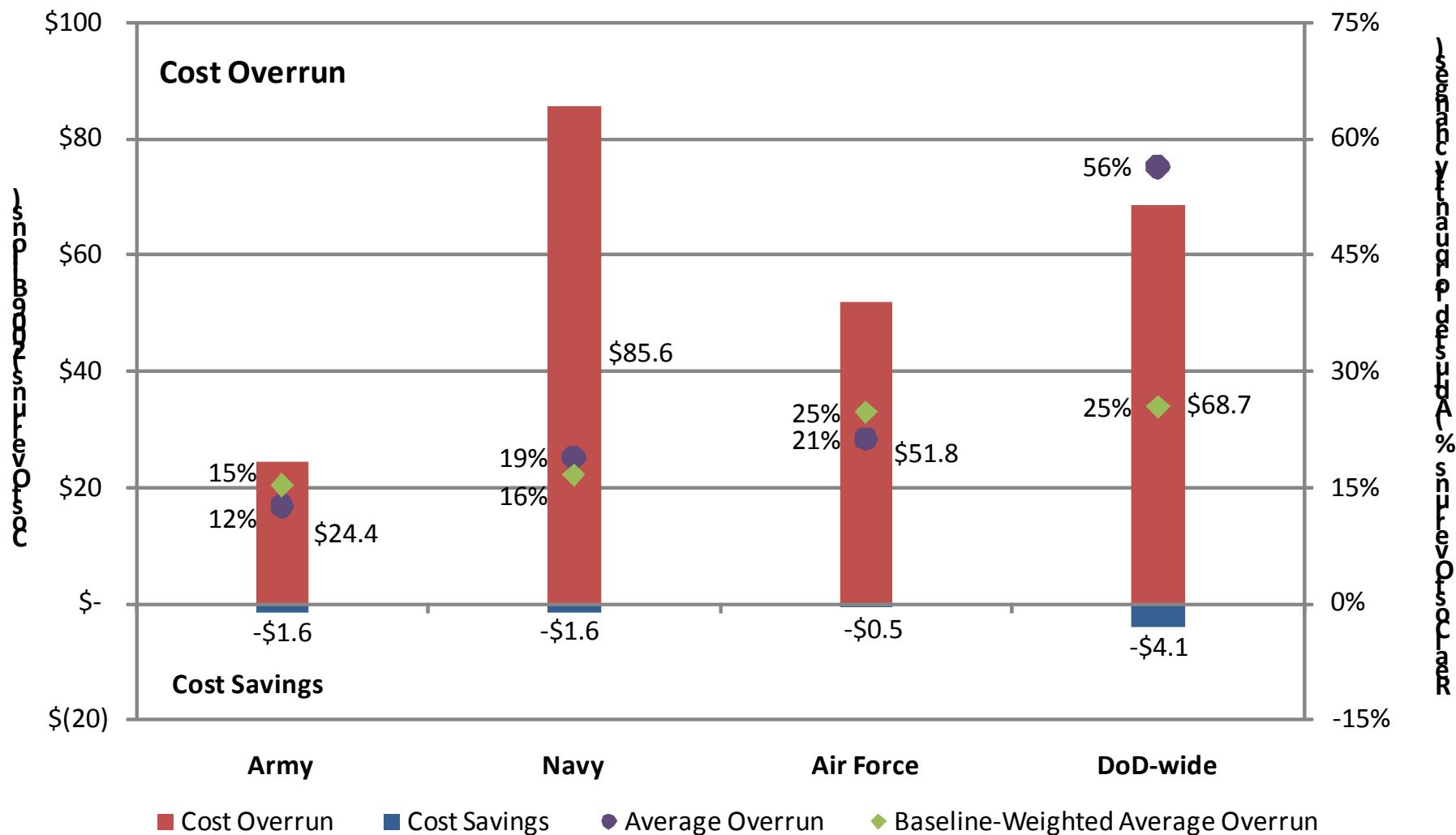
Source: December 2009 SAR; analysis by CSIS Defense-Industrial Initiatives Group

Cost overruns by lead service (I)



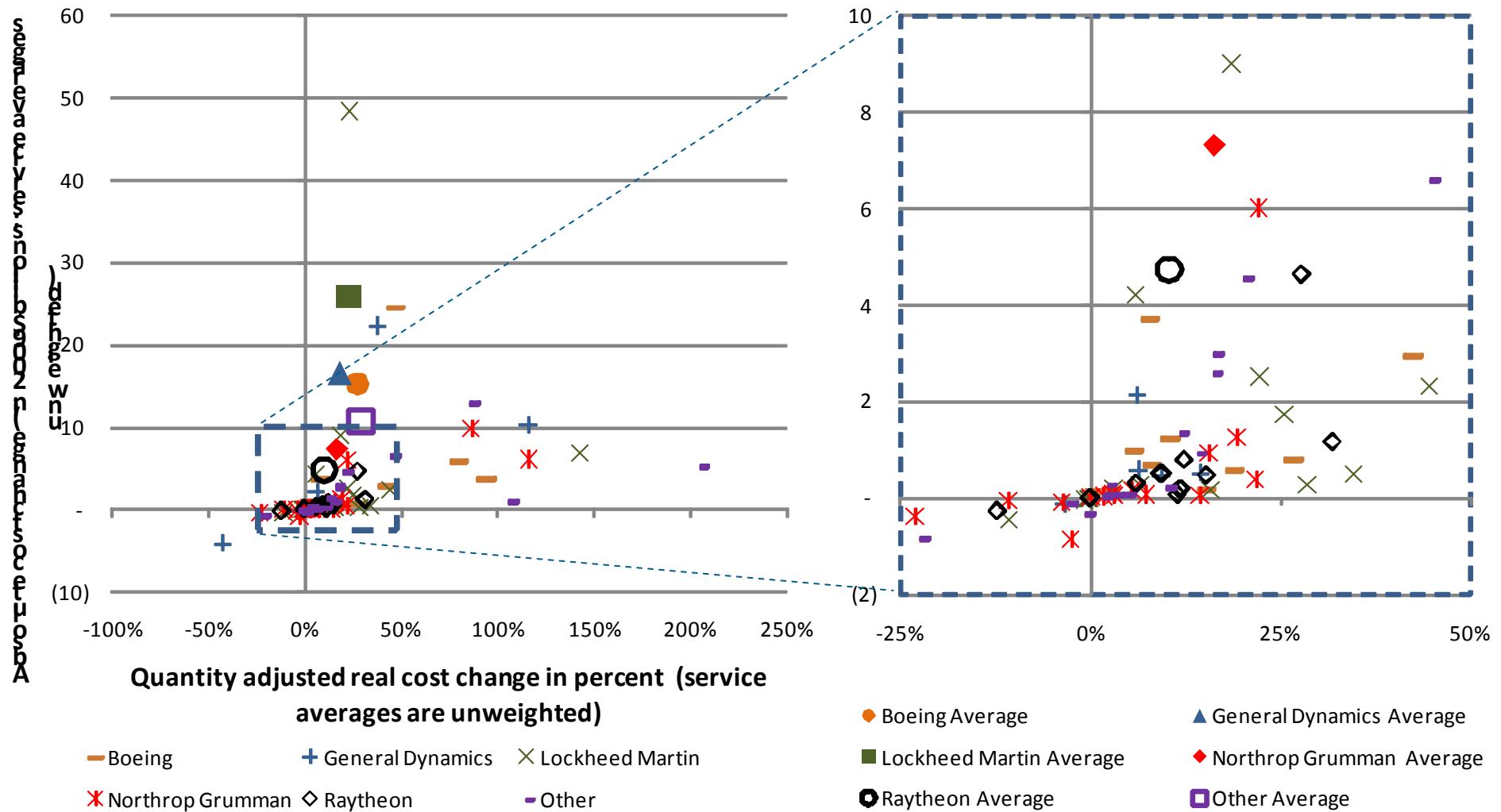
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Source: December 2009 SAR; analysis by CSIS Defense-Industrial Initiatives Group

Cost overruns by lead service (II)



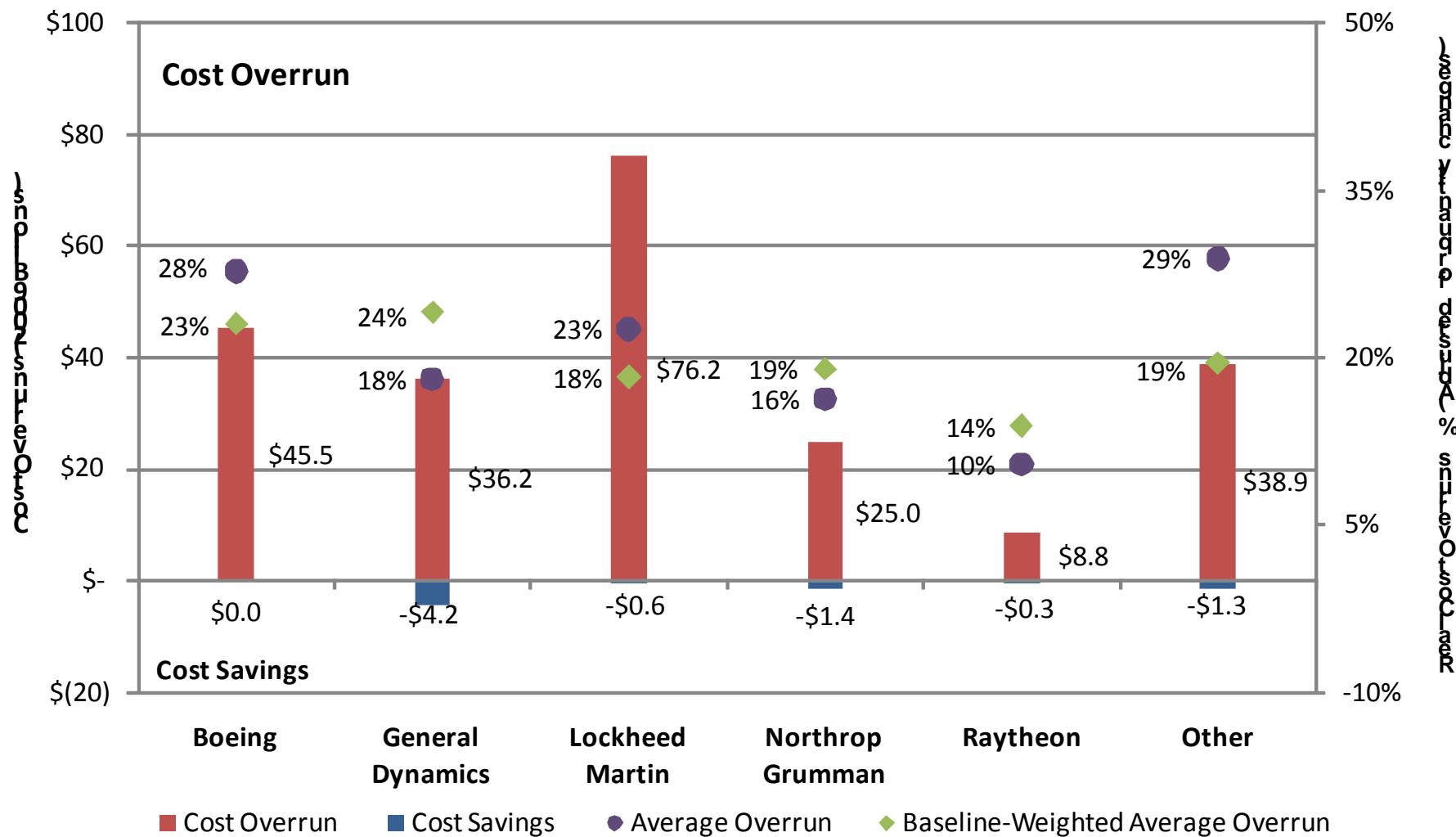
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Source: December 2009 SAR; analysis by CSIS Defense-Industrial Initiatives Group

Cost overruns by prime contractor (I)



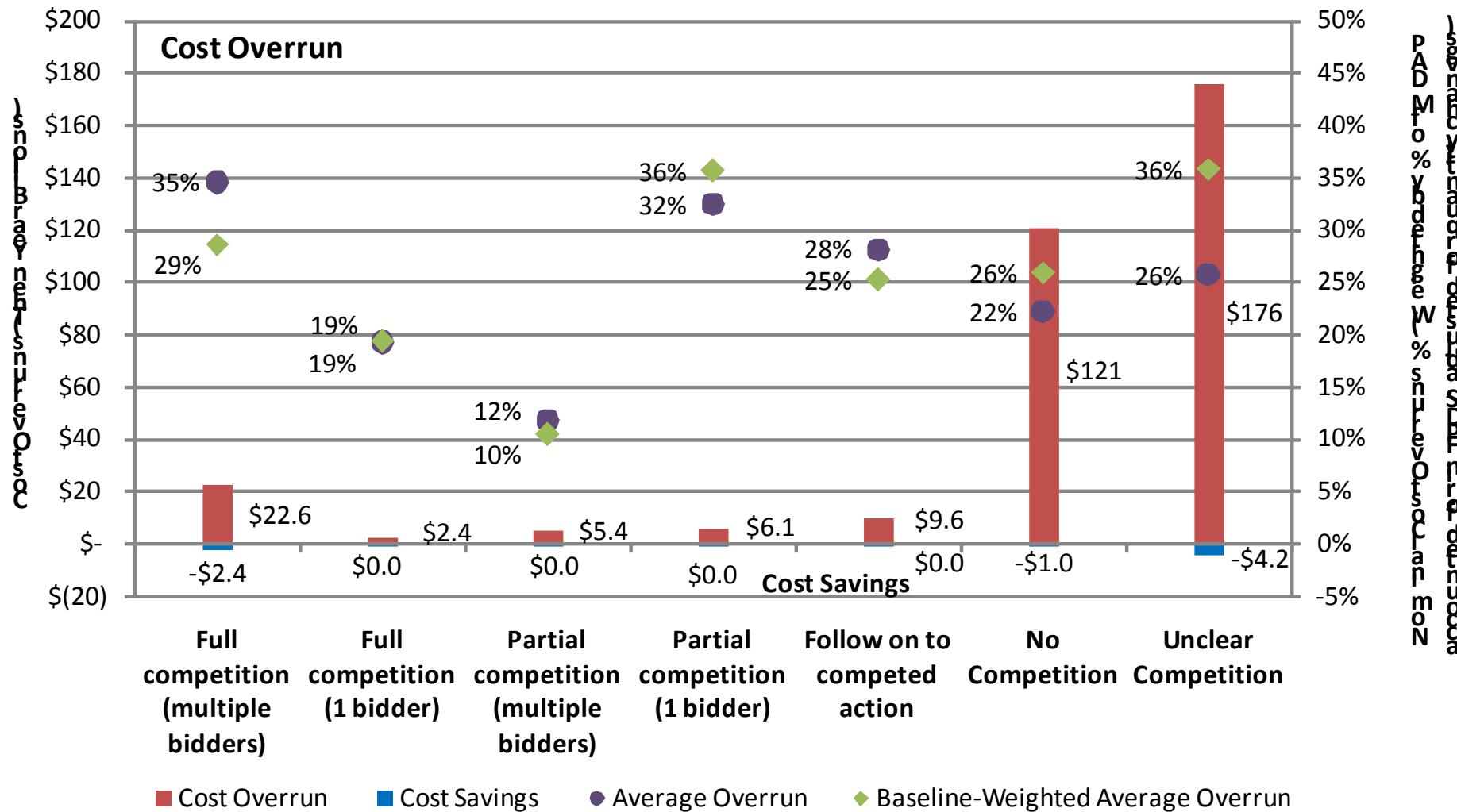
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Source: December 2009 SAR; analysis by CSIS Defense-Industrial Initiatives Group

Cost overruns by prime contractor (II)



Note: Only FY2009 MDAPs with a baseline estimate beyond Milestone B in the December 2009 SAR are included in the sample.
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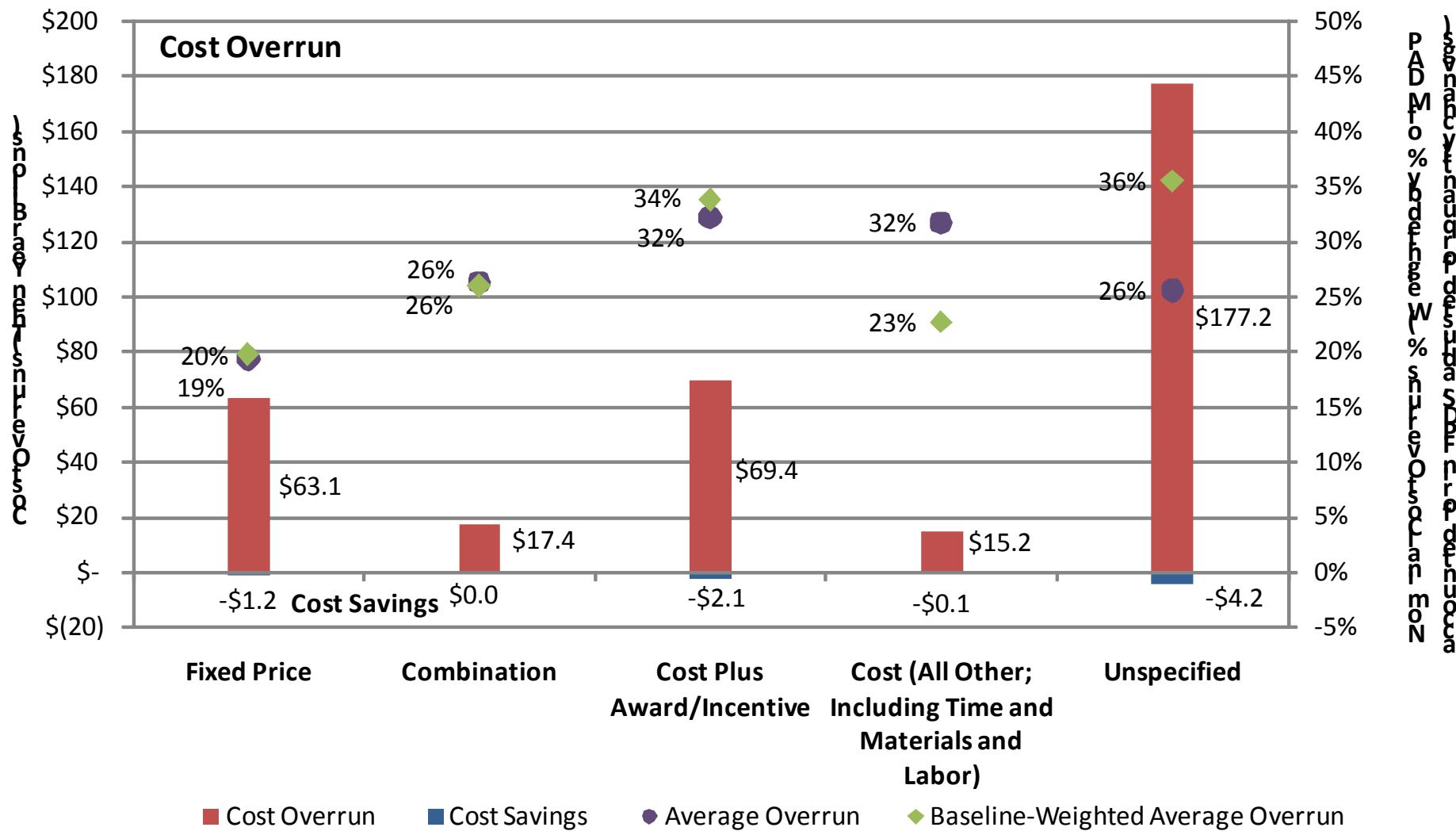
Cost overruns by type of competition



Note: Only FY2009 MDAPs with a baseline estimate beyond Milestone B in the December 2009 SAR are included in the sample.

Source: December 2009, September 2008, September 2006, and September 2004 SARs; 2004-2008 FPDS data; analysis by CSIS Defense-Industrial Initiatives Group

Cost overruns by contract type



Note: Only FY2009 MDAPs with a baseline estimate beyond Milestone B in the December 2009 SAR are included in the sample.

Source: December 2009, September 2008, September 2006, and September 2004 SARs; 2004-2008 FPDS data; analysis by CSIS Defense-Industrial Initiatives Group

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At a time of new global opportunities and challenges, the Center for Strategic and International Studies (CSIS) provides strategic insights and policy solutions to decisionmakers in government, international institutions, the private sector, and civil society. A bipartisan, nonprofit organization headquartered in Washington, DC, CSIS conducts research and analysis and develops policy initiatives that look into the future and anticipate change.

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Since 1962, CSIS has grown to become one of the world's preeminent international policy institutions, with more than 220 full-time staff and a large network of affiliated scholars focused on defense and security, regional stability, and transnational challenges ranging from energy and climate to global development and economic integration.

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